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RELATIONSHIP BETWEEN BRETEAU AND HOUSE INDICES AND CASES OF DENGUE/DENGUE HEMORRHAGIC FEVER IN KUALA LUMPUR, MALAYSIA

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ABSTRACT. The relationship between the Breteau index, the House index, and the occurrence of dengue/dengue hemorrhagic fever in the 6 zones of Kuala Lumpur was studied throughout 1994. Cases of dengue/dengue hemorrhagic fever varied between zones and between months, ranging from 0 to 21 cases. In most of the zones in Kuala Lumpur, the occurrence of dengue/dengue hemorrhagic fever has no relationship with the Breteau and House indices. Cases of dengue/dengue hemorrhagic fever occurred in all zones despite the low Breteau and House indices.

In Southeast Asia, *Aedes albopictus* (Skuse) has been incriminated as a secondary vector of dengue and *Aedes aegypti* (Linn.) as the principal vector of dengue viruses (Gould et al. 1968, Russell et al. 1969, Chan et al. 1971b, Jumali et al. 1979, Harinasuta 1984). The dengue viruses may produce occasional fatal cases, usually among children (Rudnick and Chan 1965, Harinasuta 1984). Macdonald (1956) conducted extensive studies on the distribution and dispersal of *Ae. aegypti* in Malaya. According to Chan et al. (1971a) the most common breeding habitats of *Ae. aegypti* were ant traps, earthenware jars, bowls, tanks, tin cans, and drums, with ant traps being the most common indoors and earthenware jars the most common outdoors. Breeding habitats for *Ae. albopictus* were commonly earthenware jars, tin cans, ant traps, rubber tires, bowls, and drums; ant traps were the most common indoor habitat and tin cans were the most common outdoors. The majority of *Ae. aegypti* breeding habitats were found indoors, whereas only half of all the *Ae. albopictus* breeding habitats were indoors. Sulaiman et al. (1991), in their study on distribution and abundance of *Ae. aegypti* and *Ae. albopictus* in an endemic area of dengue/dengue hemorrhagic fever in Kuala Lumpur, indicated that *Ae. albopictus* apparently was dominant to *Ae. aegypti* as a domestic mosquito species inside premises of houses, shops, and factories.

The objective of our study was to find the relationship between the Breteau and House indices and cases of dengue/dengue hemorrhagic fever in Kuala Lumpur, Malaysia.

An extensive study was conducted in Kuala Lumpur whereby the municipality was divided into 6 zones with a population of about 1.2 million. The rainfall in Kuala Lumpur for the year 1994 was between 127.9 and 426.5 mm and the mean monthly temperature was between 24.2 and 25.1°C. The 6 zones were named City Center, Damansara, Kepong, Setapak, Ceras, and Jalan Klang Lama, respectively. A total of 43,277 premises comprising houses, flats, shops, restaurants, factories, markets, construction sites, and workshops were inspected in City Center, 17,345 premises at Damansara, 34,673 premises at Kepong, 29,636 premises at Setapak, 42,835 premises at Ceras, and 22,364 premises at Jalan Klang Lama, respectively. A staff of 90 was involved in carrying out the survey throughout the year. The *Ae. aegypti* and *Ae. albopictus* identified were pooled as *Aedes* spp. and the Breteau index (number of positive containers per 100 houses) and House index (percentage of houses or premises infested with *Aedes* larvae/pupae) were determined.

All cases of confirmed dengue/dengue hemorrhagic fever from all hospitals, *viz.*, the University of Malaya teaching Hospital, Kuala Lumpur Hospital, Sentosa Medical Center, Pantai Medical Center, and Institute of Medical Research were reported to the Department of Health, Kuala Lumpur municipality. The serological test performed was the hemagglutination inhibition test of Clarke and Casals (1958). Positive cases were to be followed by chemical intervention by fogging using cyfluthrin. The correlation coefficient of the relationship between the Breteau index, the House index, and cases of dengue/dengue hemorrhagic fever was analyzed according to Meddis (1975).

The cases of dengue/dengue hemorrhagic fever varied between zones and months, ranging from 0 to 21 cases monthly (Table 1). The Setapak zone had the highest number of reported dengue/dengue hemorrhagic fever cases (117) during 1994. The Damansara zone had the low-

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Table 1. The monthly Breteau and House indices of *Aedes* spp. and reported dengue/dengue hemorrhagic fever cases in 6 zones of Kuala Lumpur city in 1994.

	City Center			Damansara			Kepong			Setapak			Ceras			Jalan Klang Lama		
Month	HI[1] (%)	BI[2]	DF/ DHF[3]	HI (%)	BI	DF/ DHF	HI (%)	BI	DF/ DHF	HI (%)	BI	DF/ DHF	HI (%)	BI	DF/ DHF	HI (%)	BI	DF/ DHF
Jan.	4.7	7	9	5.7	6	6	1.8	2	8	3.2	5	8	1.3	2	13	1.5	2	4
Feb.	4.9	7	8	5.2	5	8	2.7	3	0	3.8	4	8	2.3	3	9	1.4	2	6
March	3.2	4	1	2.1	2	5	2.6	3	5	0.9	1	8	1.7	2	11	0.1	1	6
April	4.9	7	9	2.2	3	4	2.0	3	7	2.6	3	9	3.0	4	6	1.5	2	15
May	3.9	5	7	2.7	3	1	2.8	5	3	3.6	4	10	2.4	3	5	1.1	1	2
June	3.7	5	6	3.0	7	0	1.5	2	0	2.3	3	4	1.6	2	5	0.8	1	3
July	3.6	4	9	4.8	5	3	1.4	2	1	2.8	3	3	1.4	2	6	0.5	1	3
Aug.	3.2	4	7	6.5	7	6	2.1	3	3	1.5	2	12	0.9	1	7	1.2	1	9
Sept.	3.7	4	5	3.8	10	2	1.7	2	2	2.0	2	8	1.3	2	6	0.5	1	8
Oct.	4.6	7	7	7.5	11	0	2.7	4	1	2.6	4	19	0.9	1	3	1.1	1	3
Nov.	4.5	7	11	4.4	5	1	4.5	5	8	3.4	4	21	2.7	3	3	2.3	2	8
Dec.	4.5	6	7	7.2	7	6	1.7	2	7	1.4	1	7	1.5	2	6	3.3	3	1
Totals			86			42			45			117			80			68

[1] HI = House index.
[2] BI = Breteau index.
[3] DF/DHF = Dengue fever and dengue hemorrhagic fever.

est number of cases (42). The difference could be because the Setapak zone contained more slum areas with poor and improper sanitation, whereas the Damansara zone was highly developed with good sanitation facilities. According to Gubler (1989), one factor that has contributed to the failure of most Latin American countries to control *Aedes aegypti* during recent years has been the increasing production of solid waste coupled with inadequate refuse collection services.

The correlation coefficient (r) of the relationship between the Breteau index and dengue/dengue hemorrhagic fever cases in each month was not significant in the zones of Jalan Klang Lama ($r = 0.02$, $P > 0.05$), Ceras ($r = -0.04$, $P > 0.05$), Setapak ($r = 0.32$, $P > 0.05$), Kepong ($r = 0.13$, $P > 0.05$), and Damansara ($r = -0.29$, $P > 0.05$). However, in the City Center zone the correlation coefficient was significant at the 5% level ($r = 0.60$, $P < 0.05$). Similarly, the correlation coefficient of the relationship between the House index and dengue/dengue hemorrhagic fever cases in each month was not significant in the zones of Jalan Klang Lama ($r = -0.09$, $P > 0.05$), Ceras ($r = -0.15$, $P > 0.05$), Setapak ($r = 0.21$, $P > 0.05$), Kepong ($r = 0.29$, $P > 0.05$), and Damansara ($r = 0.24$, $P > 0.05$). However, in the City Center zone the correlation coefficient was significant at the 2.5% level ($r = 0.61$, $P < 0.025$). Thus, in most of the zones in Kuala Lumpur, the occurrence of dengue/dengue hemorrhagic fever cases had no relationship with either the House index or the Breteau index.

In Singapore, the *Aedes* House index has been reduced to 2% since 1983, but in spite of this 3 epidemics of dengue/dengue hemorrhagic fever have occurred–in 1986, 1987, and 1989. In 1989, stepped up control measures were undertaken and 390,345 premises were checked; 5,043 or 1.3% were found to be positive for *Aedes aegypti* (World Health Organization 1990). Studies in Singapore in 1991 indicated that dengue fever/dengue hemorrhagic fever was significantly correlated with the *Aedes* House index. Major habitats were ornamental and domestic containers (Anonymous 1992). Thus, our finding contradicted the studies in Singapore.

Ho and Vythilingam (1980), in their survey of *Ae. aegypti* in Selangor, peninsular Malaysia, indicated that the most common indoor larval habitat in urban areas is the bathroom tank. In both urban and rural areas, the outdoor preference is for earthenware jars. Lee and Cheong (1987), in a preliminary *Ae. aegypti* larval survey in the suburbs of Kuala Lumpur city, found that the premise and Breteau indices of 3 localities in the study area exceeded the 5% and 20 level, respectively, indicating that these localities were at risk of dengue outbreak. Both *Ae. aegypti* and *Ae. albopictus* were found breeding indoors and outdoors in a number of containers used for water storage.

According to Tonn et al. (1969) there was evidence of slight changes in the number of oc-

cupied habitats from time to time, the chief increase being between the cool and the warm seasons and the chief decrease from the wet to the cool season. However, it seems unlikely that outbreaks of dengue hemorrhagic fever can be explained by increases in *Ae. aegypti* densities during the wet season. Tonn et al. (1970), in their study on magnitude of seasonal changes in larval populations of *Ae. aegypti* in Bangkok, Thailand, concluded that there was some reduction in the larval population during the cool and hot seasons and that the magnitude and timing of the decrease varied from place to place. The reduction was of the order of 11–26%. Local environmental changes, as well as climatic changes, greatly influenced the *Ae. aegypti* population. Gould et al. (1968), in their entomologic studies on Koh Samui Island in Thailand, found that *Ae. aegypti* and *Ae. albopictus* appeared to coexist. Southwood et al. (1972), in their studies on the life budget of *Ae. aegypti* in Wat Samphaya, Bangkok, Thailand, stated that there was no clear trend of association between mortality and season except for a decrease in larval mortality in April–May preceding the increase in annual incidence of hemorrhagic fever, which usually occurs in June.

To conclude, the present study indicated that cases of dengue/dengue hemorrhagic fever occurred in all zones of Kuala Lumpur despite the low Breteau and House indices.

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